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ABSTRACT

The use of electronic mail has increased in organizations and other areas where computers are used. Researchers report that there are some major effects on the organization and organizational members in group and interpersonal communication. An extensive literature review examined the technology used in computer networks, electronic mail and message systems, effects on the organization, and members of organizations. A study examined some of the differences between computer mediated communication and non computer mediated communication. Subjects, college students and users of three bulletin board services, responded to a single-question survey, either electronically or on paper. Responses were analyzed using a writing analyst computer program (Grammatik III). The computer mediated group did score higher on all the tests for readability, etc. Results indicated that there were some differences between the two types of communication, but further study is needed to clearly establish what those differences are. Implications for teachers of technical writing may be that more on line writing skills need to be developed in writing courses. (Two tables of data are included, and 28 references are attached.) (Author/SR)

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Differences Between
Computer and Non Computer
Mediated Communication:
A Preliminary Experimental Study

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Abstract

The use of electronic mail has increased in use in the organization and other areas where computers are used. Researchers report that there are some major effects on the organization and organizational members in group and interpersonal communication. This study examined the technology used in computer networks, electronic mail and message systems, effects on the organization and members of organizations. An experimental design was used to examine some of the differences between computer mediated communication and non computer mediated communication. The results indicated that there were some differences between the two types of communication, but further study is needed to clearly establish what those differences are.

Introduction and Overview

In 1986 public access message systems reached over \$100 million a year in revenue (Tucker, 1986). This total does not take into account the hundreds of thousands of personal computers linked onto local area networks (Bender, 1988). Even as long ago as 1984, over half of the Fortune 500 companies had established some type of local area network (LAN) system (Burstein, 1986). Electronic mail or message systems is one of the most used functions of a local area network (Haberfelde, 1988).

Electronic mail has become a way of life for members of many organizations. A 1985 survey reported that 71 percent of Fortune 1000 companies planned to have a computerized message system by 1986 (Rice, 1987). By the end of 1985, there were over 1 million commercial "electronic mailboxes" sending 12.5 million messages per month and there are literally hundreds of thousands of personal computers linked onto local area networks where electronic messages are the most used function (Burstein, 1986; Haberfelde, 1988; Rice, 1987). The electronic mail box has for all practical purposes, replaced the paper memo and letter in many organizations. Electronic mail and electronic message systems are practical media of communication in the organization and to some extent the public at large.

There are several questions which need to be asked concerning the use of electronic message systems. How has electronic mail influenced the organization? What kinds of effects does electronic mail have on the organization and its members? Are there any differences between electronic mail and the traditional paper mail messages sent in the organization? The answers to these questions may influence how messages are sent using

computer technology. There may also be implications for the way writing is taught in educational programs.

The current literature of the following areas will be explored: (1) computer technology needed for organizational type systems as well as public access systems; (2) electronic mail and messages systems; (3) their effects on organizations; (4) how they are used; and (4) some of the differences from more traditional media. The paper is not intended to explain the different hardware and software configurations that are possible in organizations, nor all of the commercially available systems, but to provide an overview of the concepts appropriate to the study of such systems¹. A qualitative methodological approach will be used to explore some of the differences between electronic messages and traditional hand written messages.

Review of Literature

A computer is a very high speed electronic device that can accept data and instructions, use the instructions to perform logical and mathematical operations, and report the results of the processing in the form of information (Burstein, 1986; Gersting & Gemignani, 1988). A computer is not usually used alone but is part of a convergence of equipment put together to form a system referred to as an information system. Information systems are also known as data-processing systems, business-computer systems, electronic-data processing systems, and information processing systems. Burstein (1986) defines an information system as a set of interrelated elements working together to produce information (p. 11). The elements in the system obtain data, processes or converts the data into information, and then communicates the information to decision makers.

Computer Systems

The computing process involves three stages: input, processing, and output (Burstein, 1986). The equipment used in the process include the computer, software, and peripheral devices. The heart of the system is the computer. Attached to the computer are the peripheral devices such as a keyboard, printer, or monitors. The computer and all peripheral devices are referred to as hardware. Software is a general name given to the programs or the lists of precise instructions written in a language the computer can understand. The software tells the computer how to proceed step by step on a particular processing job (Burstein, 1986, p. 11).

A computer or computer system does not exist in a vacuum in an organization. There are several components necessary in order for the system and the process of computing to work effectively. Burstein (1986) outlines five elements of an information system. The first element is the people who run or depend on the system-the users. The second element is the organization's rules and procedures. The rules and procedures include the overall rules of running the organization and any special rules or procedures for the use of the computing system. The third element includes the data or facts from which information is drawn - what the people input into the system. The fourth is the software run on the computers. The fifth element includes the hardware, the computers and all peripheral equipment that physically handle and processes the data. These elements taken together make up the information system and help to establish the types of messages and work included in an organization. These elements can be included when discussing public message systems and electronic bulletin boards.

There are three levels of computer sophistication: the personal computer, the minicomputer, and the mainframe computer.² Microcomputers or personal computers (PC) are the smallest type computer. The PC is generally found in homes and offices (Burstein, 1986). Examples of PCs would include the International Business Machine (IBM) PS/2, AT, and XT, Apple Macintosh, or Compaq computer systems. The minicomputer is larger, faster, and has more memory capacity than the typical microcomputer.

A typical PC can have anywhere from 64 kilobytes to 2 megabytes of internal computer memory.¹ An average minicomputer can have a gigabyte, equal to 1,000 megabytes, of memory storage capacity. An example of the minicomputer would be the Digital Equipment Corporation (DEC) VAX family of computers. The mainframe computer is similar to the minicomputer and they range over a wide spectrum of processing speeds and other capabilities (Burstein, 1986). A usual characteristic of the mainframe is the physical size of the system, which usually requires special surroundings and equipment, such as air conditioning and humidity control, for its maintenance. Both the mini and mainframe can be linked to many terminals or computers simultaneously without special intermediate equipment, while microcomputers usually will need a server mechanism in order to be linked together. Linking computers in a network will be discussed later in the paper.

Today's generation of computers, specifically those computers with the Intel 80386 and 80486 processing unit, makes the distinction between microcomputer and minicomputer blurred. The processing speed and storage capabilities previously known only to the minicomputer are now being realized with this generation of computers. In addition, the new machines can serve

several other computers or stations at the same time without a significant loss of processing speed.

In addition to the computers and peripheral devices, electronic networks require special communication devices in order for the computers to be linked to each other. This linkage is necessary in order for electronic mail to be sent from one person to another. A network is a combination of devices linked together for teleprocessing. The devices can be both computers and peripherals (Burstein, 1986).⁴ There are two types of computer networks. The local area network or LAN and long haul network (Gersting & Gemignani, 1988) or distance computer network.

Local Area Networks

Local area networks provide offices with the capability of teleprocessing in a small setting such as an office or set of offices. To be a LAN, a network must have full connectivity among the stations, be fully administered by the owner, and run on a single set of cables (Lefkon, 1987). The long-haul network can connect computers that may be hundreds or thousands of miles apart. Typical long-haul communication media operate at speeds of a few thousand bits per second, while the media used in LANs operate at a few million bits per second (Meadow & Tedesco, 1985).

There are several qualities to a local area network. One is that the LAN connects some group, such as an office, the buildings in an industrial complex, or offices located in a particular city or region (Williams, 1987). A second would be the LAN can be used to transfer files and information between microcomputers of widely different architecture (Lefkon, 1987). Another feature is that the network is purchased or leased for the sole use of its owner or client and not a common carrier (Williams, 1987). Tucker (1986)

describes four basic services usually included in a network. The sending and receiving of mail electronically; the long distance use of one computer by several terminals; the posting of news on specialized "bulletin boards"; and the searching and reading of information known as databases (p.2).

Types of Networks.

Networking, both local and distance, requires special equipment and peripheral devices. This section will describe some of the possible arrangements of LANs. The different configurations may have an effect on how messages are transferred from one user to another. The particular form of the network reflects the structure and size of the organization, the applications for which it requires, and the technology available to the organization (Burstein, 1986). There are four general types of networks that can be used to link personal computers together: star, hierarchial, ring, and multiply connected.

The star network has a central computer connected to remote peripherals or other computers, which are not connected to each other. If terminals form the points of the star, then the configuration is considered liberated (Burstein, 1986) - the one computer does everything and the users of the network have terminals to access the system. If microcomputers or other types of computers are used as points of the star then the network is considered a distributed form in which the central computer remains in command (Burstein, 1986). An example of a star network with computers at the points would be a department store with several branches. The main department store has the central computer at the center of the star pattern. The central computer performs most processing for all the stores, such as keeping personnel records, writing paychecks, and analyzing sales trends.

Each branch has its own minicomputer to keep track of sales data. The data is communicated to the central computer where it is processed.

Hierarchical network has a main computer at its top, the most important level in terms of control. Communication links spread downward and outward, much like the roots of a tree. At each branching point is a computer; the farther down the hierarchy, the smaller the computer. The main computer at the top of the hierarchy is in command of everything, with successively subordinate tasks performed at each lower level (Burstein, 1986; Gersting & Gemignani, 1988).

Ring network, sometimes referred to as a token ring, links computers into a loop. The loop has no central computer; instead all the computers are equal and communicate with one another. For example, several mainframes might be hooked together in a loop for a large insurance firm. Users could perform the processing they needed at a particular computer, and also could communicate through that computer with any of the others in the loop when necessary (Burstein, 1986). In a token ring LAN, a special packet (encoded message) is circulated about the network. If station A has this token, it can attach addressing information and data to it and request service from station C. The packet passes through station B's buffer area unchanged because B does not see its name in the packet. C receives the packet and sends back a frame that is nearly identical but has a "received" bit turned on. D passes this along, and when A receives it and verifies that the data was received intact, A places a fresh token on the network so that another node can transmit (Lefkon, 1987).

Multiply connected networks, sometimes called a bus, allow computers to communicate along two or more possible paths. In this network not only can

one computer share another's job, as in the ring network, but alternate telecommunications media are available between any two computers should one link fail. The line is shared by a number of links as a single channel for all stations to transmit information. A station can send data to a head-end retransmitter that will then rebroadcast the information back to the bus (Burstein, 1986; Lefkon, 1987; Meadow & Tedesco, 1985).

In the long haul or distance network, a single user may connect onto another computer or a computer network. For example, a manager working at home may tie into the company's mainframe, an individual may link with a fee bases system such as COMPUSERVE, or a free service such as a local bulletin board. The requirements for distance computing are a PC, a modem, and a host computer system or network.

Some distance computer systems can be wired directly, most distance computing requires the use of the telephone system. The special requirements for distance computing over the phone system provide special problems for the computer user. For example, the speed of transmission is greatly reduced, in order to send and receive messages in the network, the user must log onto the system, which in turn reduces the turn around time for message transmission and reception. Because most distance systems require the use of the telephone, a modem is necessary for a link on to the system. Computers generate digital signals, which show an abrupt on and off pattern. The telephone accepts only analog signals that show rounded wave patterns. To transmit digital signals over analog telecommunication media requires that the original signal be translated from digital to analog patterns. The process is called modulation. The modem converts the digital signal into a form that can be carried over analog lines and is converted back to digital form at the

receiving end, a process called demodulation. A modem performs the tasks of modulation and demodulation (Burstein, 1986; Gersting & Gemignani, 1988; Bullough & Beatty, 1987).

Bulletin Boards.

Bulletin boards have become a popular means of message exchange. The October, 1989 issue of Computer Shopper lists over 700 bulletin boards across the country. According to Bowen (1987) most bulletin board systems (BBS) fall into one of five distinct categories. The general interest BBS caters to a large audience, with message bases devoted to several topics, a generous supply of public domain software, news, and entertainment. The technical BBS deals with questions about DOS (disk operating system), hardware, and programming. System-specific boards focus on a particular brand of computer system and contain compatibility tips and information on related issues.

Special interest BBSs offer information on non-computer subjects. Other boards exist primarily as sources for the many public domain programs available and contain massive libraries of files you can download. A bulletin board is primarily designed to let users exchange messages (Troutman, White, & Breit 1988). The host computer is established at some location and remains in an answer mode. Users can then call the board to read or leave messages. Virtually all the BBSs run single-user microcomputers. They have been set up by individuals, computer clubs, and commercial outlets. On most systems the only database is the current bulletin board of messages, posted by other callers. Each BBS establishes its own audience after a short time in operation (Bullough & Beatty, 1987).

Whether messages are being sent over a local area network or long distance to a bulletin board system, electronic communication has changed the

way some people communicate. Office communication no longer relies on the paper system, and managers don't have to play telephone tag with other managers or subordinates. The network system in place or in use helps to determine the types of messages transmitted and received.

Electronic Message Systems

Electronic mail systems are referred to by a variety of titles including: E-Mail, electronic message systems (EMS), computer mediated communication (CMC), computerized messages systems (CMS), and computer-mediated communication systems (CMCS). Electronic message systems may also include a variety of components such as electronic voice message systems, computerized voice mail systems, telex, bulletin board systems, commercial information systems, teleconferencing, and commercial electronic mail systems. The common components of these terms are that a computer is linked to one or several other computers and messages are exchanged or sent to another person or persons. Cross and Raizman (1986, p. 3) provide a general definition of electronic mail:

Electronic mail (EM) is an electronic communications system that is used to send information from one person/site to another (one-to-one communication), or from one person to many people at the same time (called broadcasting or one-to-many communications).

Depending on the system used, electronic messages can comprise data, text, audio, or graphic information.

Cross and Raizman's definition incorporates the elements found in other definitions and covers the most widely accepted concepts.

The electronic mail systems are usually incorporated into the organization's computer systems or office automation (OA) system. There are

three common types of systems (Cross & Raizman, 1986). Cross and Raizman (1986, pp. 36-40) outline the different types of systems used in organizations. The first is the dedicated office automation systems. The dedicated office system is an in-house system dedicated to carrying out specific functions. They have become an economic necessity to small businesses, and a means for reducing the staffs of very large organizations. The second is the office automation/data processing (OA/DP) systems. OA/DP systems are basic data processing systems on to which OA systems have been grafted. OA/DPs are usually found in medium to large business organizations. The third system is the office automation/private branch exchange system (OA/PBX). The OA/PBX systems are generally built upon internal computerized telephone networks. The following individual component systems represent standard automated office configuration: Word processing, data processing, records processing, printing, scanning/sending (for example, facsimile machines and text scanners), administrative support, decision support, voice mail, and teleconferencing.

Message Systems and the Individual

The computers are networked into a system similar to that of a human communication network. A network is a way of sharing information, processing information, and communicating. Human communication networks are the model for computer networks (Weidlein & Cross, 1986). A computer network extends people to people communication and provides instantaneous access to data and information banks. By broadening access to information and by networking channels of communication, the individual user can work easily with other, and the whole process become greater than the sum of its individual parts (Weidlein & Cross, 1986, p. 7). The personal computer (PC) network can introduce new ways to carry out traditional tasks.

A PC makes it quick and easy to carry out normal business functions. Instant access to people and information resources within the office, and access over public and private transmission networks to distant locations means that organizations are closer than ever before to communicating with anyone, anywhere, and anytime (Weidlein & Cross, 1986, p. 24).

The individuals who are more likely to use the computer network most often include the professional worker, such as managers, accountants, analysts, planners, and engineers (Weidlein & Cross, 1986, p. 25). Clerical workers input the most information in to the network, while professionals and executives who work away from the office and need to communicate with the main office comprise the next level of usage (Weidlein & Cross, 1986; Rice, 1987; Helliwell, 1986). Top level managers and executives are the least likely to use networks and message systems (Weidlein & Cross, 1986; Helliwell, 1986). This data suggests that the heaviest users of networks and messages systems are those who usually do most of the work in the organization and are in the most need to send and receive the most information.

Message Systems and Organizational Structure

The computer network and message systems seem to have an effect on the structure of the organization. According to Rice (1987) studies of messages systems have shown subsequent increase in overall direction, amount, and diversity of communication linkages in the organization. The use of message systems may remove some of the typical constraints and influences of sending and receiving of communication found in many organizations (Rice & Love, 1987). When one person communicates to another in the context of the organization, individual roles, organizational norms, structures, procedures, and politics, may influence the when, where and how the communication takes

place. The use of a message system can remove these controls from the interaction. The communication between members in the organization has the potential to become less structured and more open. Open communication is usually a goal for many organizations.

Message Systems and Interpersonal Communication

Message systems also influence interpersonal communication. Reder and Schwab (1989) point out that face-to-face conversation and electronic mail are becoming functionally equivalent in many organizations. Electronic mail is often substituted for face-to-face communication among individuals who are working closely together on a project and who are in need of frequent communication (Reder & Schwab, 1989, p. 183). Kerr and Hiltz (1982) conclude that computerized communication can increase affective ties and the sense of personal interaction, and can allow some communicators to bypass typical social protocols and become intimate more quickly. Additionally, computer mediated communication creates opportunities for communicating and joining groups without the intrusion of sex, race, physical appearance, or other irrelevant characteristics (Kerr & Hiltz, 1982, p. 115). The message systems can remove many of the traditional limitations on communication because it is freed from the constraints of time and space.

Electronic mail can create more time for individual workers and managers. Messages can be copied effortlessly and forwarded to the head of the department or organization without interrupting him or her which means that the worker increases their job satisfaction (Cross & Raizman, 1986, p. 11). Users are able to expand personal and professional networks worldwide at minimal cost, and to use conferencing systems to substitute for the prior absence of communication.

Most studies report increased communication among users following implementation of the systems (Freeman, (1980); Hiltz, 1983; Rice, 1987, Rice & Love, 1987). Electronic message systems have the capacity to influence interpersonal communication in a positive manner. If an individual does not have to be concerned with potential biases or if there is little concern for social protocols, the assumption is that there will be greater interaction among organizational members. Consequently, with greater message flow, more cooperative work can be accomplished with greater accuracy.

Message Systems and Group Communication

On the group level, Kerr and Hiltz (1982) speculate that geographical dispersed groups are able to communicate at a speed and cost superior to telephone, mail, and face-to-face meetings. They go on to explain that computer communication increases cross group communication, lateral network linkages among groups, lateral network linkages within groups, reduces the lag time of learning more and more quickly of events of interest to the members of the group, may increase informal communication, and there is greater equality of participation than in conventional media (Kerr & Hiltz, 1982, pp. 132-134).

Harassim (1987) in a study of an educational grouped found the students in the on line groups reported that in their opinion the on line medium promoted more equal participation than do face-to-face classes. Students also reported that this factor contributed to increased participation. Students reported that the increased participation in the on line courses contributed as well to learning effectiveness (Harassim, 1987, p. 181). In another study in an educational setting, Roberts and Garg (1983), found that respondents highly favored the use of the group communication system in meetings with regard to

anonymity, immediate feedback, efficiency/speed in voting, and overall use in communication. The use of a message system in group settings appears to have a profound impact on the way group members can communicate with each other. The computer has the potential for increasing group effectiveness, and consequently, group decision making and problem-solving. One of the greatest complaints of group members is the lack of equal participation. If the computer message system can increase member participation, then one of the most important barriers to group work can be resolved.

Advantages of Electronic Mail

There are a number of overall advantages to individuals and organizations when using electronic mail over the more traditional mail and telephone systems. Traditional mail is one-way communication in which a person sends a message without being able to interact with the recipient. Because electronic messages are transmitted almost instantaneously, E-mail can effectively become two-way communication, allowing sender and recipient to interact as they attempt to resolve problems or make decisions (Cross & Raizman, 1986). Another advantage of E-mail over traditional mail is that "the message always goes through," whereas letters are not delivered by the postal service on sundays or holidays or during postal strikes, and may not be delivered in severe weather.

International mail is even more of a problem, letters often take weeks to arrive and sometimes do not arrive at all. Other advantages of E-mail include: its more convenient to mail an electronic letter because it can be sent automatically from a desktop; users can read mail as soon as it arrives or wait until they have time to read it; is cost effective because it saves mailing time, costs of postage, and paper. Management and staff productivity is

enhanced where there is a smooth flow of information. The organization can respond quickly to requests from outside the organization. E-mail can save time wasted in "telephone tag" and back and forth calling (Helliwell, 1986; Weidlein & Cross, 1986; Cross & Raizman, 1986). A study by Manufacturers Hanover Trust, the fourth largest U. S. commercial bank, found that E-mail saved 3,000 of its employees about 36 minutes each day. This amounted to a savings for the bank of \$7 million in 1982 (Nyce & Groppa, 1983).

Negative Effects of Message Systems

Not all of the influences of electronic message systems are positive. Kerr and Hiltz (1982) point out that the volume and pace of information in an electronic system can become overwhelming, especially since messages are not necessarily sequential and multiple topic threads are common, resulting in information overload. Information overload presents itself first as a problem, then as a constant challenge to overcome. Some of the positive influences cited earlier also may be problematic for organizations. By relaxing the more traditional structures and roles, lines of authority may be confused, lines of communication may break down causing a bypass of information to proper levels, and inappropriate mixing of roles and norms.

Comparison of Computer and Non-Computer Mediated Communication

Hiltz and Turoff (1985) contend that computer mediated communication is better thought out, better organized, and richer than natural conversation. Phillips (1982) in an informal content analysis of messages from three computer conferences indicated that the users of the system had a "stream of consciousness flow of thought" that exhibited creativity and spontaneity. Reder and Schwab (1989) point out that E-mail has become functionally equivalent with some types of conversation, on one hand, and with other types

of writing on the other hand. Rice and Love (1987) found that electronic messages contain socioemotional content and that the more a person uses the system the more socioemotional content is included (p. 101).

Kochen (1978) suggests that the form of linguistic communication used in computer mediated communication may very well be neither conversational nor written, but a "new linguistic entity with its own vocabulary, syntax, and pragmatics." Reder and Schwab (1989) supports this point when they found that computer mediated communication does not have a uniform set of interactive or functional characteristics and that these messages will assume a variety of socio functional niches within the overall communicative economy of the setting, not just one niche (p. 192).

Conclusions

Clearly, there are some differences between computer messages and non computer messages. What those differences are have not been clearly established in the literature. There are also a number of similarities found between the two types of messages. Further study is needed to determine conclusively the distinctions between computer mediated electronic messages and other types of messages. An electronic message system has some distinct advantages over the more traditional paper and interpersonal networks found in many organizations. As the use of electronic message systems increase so do some of the problems associated with those systems.

Method

Subjects

There were two sets of subjects for the study. The first set of subjects were students in upper level communication classes at an eastern university. Two classes from the communication department were chosen at

random from the Fall 1989 class schedule using a table of random numbers. This portion of the sample population was chosen because of the availability and access of the students.

The second set of subjects for the study was derived from three local bulletin board services. A message was placed on each of the boards to elicit responses. The responses were copied and numbered. The messages were chosen at random using a table of random numbers.

Both sets of subjects were similar in age and background. The mean age of the computer mediated sample was 18 while the mean age for the non computer mediated sample was 19.5. The majority of the computer mediated sample were college students and the remainder were professionals.

Materials

The examples of messages were derived by asking the subjects to respond to a request for assistance to respond to a single question survey on how users enjoyed using a computer. The message was left on the electronic mail section of the local bulletin board services. The in-class group was handed a photocopied sheet of the request and asked to read the hand out and follow the directions.

Grammatik III, a writing analyst computer program, was used to analyze both the computer mediated and non computer mediated messages. The program analyzes the language and scores each on a variety of tests. The tests used in this study were the Flesch Reading Ease score to determine relative reading ease. The Reading Ease score varies from 0, very difficult to read to 100, very easy to read (Wampler & Williams, 1988). The second score used was the Flesch-Kincaid (F K) formula. The score gives a grade level readability score, indicating the average number of school years needed to

understand the work. The third score used was the Gunning Fog Index. This score roughly corresponds to the grade level needed to understand the work. The numbers this method produces tend to be a bit higher than those produced by the Flesch-Kincaid method (Wampler, & Williams, 1988).

Design and Procedure

Writing samples were collected from the local bulletin board services over a two week period. Each service was accessed and the messages captured using a communications program. The messages were edited to remove names and other extraneous data captured with the message. Each message was saved in a separate file and analyzed using Grammatik III. The results of the program's analysis was recorded for statistical measurement.

Writing samples of the students were collected over a two day period by the instructors of those courses. The samples were typed into a word processor exactly as they appeared on paper. Each message was saved in individual files and analyzed using the same procedure as the computer mediated messages.

Both the computer and non computer mediated message were analyzed twice by Grammatik III to determine if any differences occurred. No differences were noted. All of the computer mediated messages and all of the non computer mediated messages were analyzed to get an overall score on the different tests.

Results

Eight responses were received from the bulletin board services. Three responses were removed because of insufficient length (each was one sentence). Seventeen responses were received from the non CMC group. Five responses were removed because of insufficient length. Five responses were

chosen at random to provide an equal number of responses to the CMC group. The means for the three tests are provided in Table 1. The CMC group produced generally higher scores in all three categories. A t-Test analysis yielded slight, but statistically significant differences between the groups in the Flesch test ($t=2.73$, $p < .05$) and in the Flesch Kincaid tests ($t=2.09$, $P < .05$). The Gunning test did produce a variance; however, the variance was statistically insignificant ($t=1.83$, $p < .1$).

A Pearson Product Correlation analysis was completed for the Flesch and Gunning tests and the Gunning and Flesch-Kincaid tests. The results of the correlation tests are reported in Table 2. There appeared to be a high correlation between the Gunning and Flesch-Kincaid tests ($r=.938$, $p < .1$ CMC and $r=.823$, $p < .1$ Non CMC). There did not appear to be a correlation between the Flesch and the Gunning tests ($r=.144$, $p < .1$ and $r=-.902$, $p < .1$). There also did not appear to be a correlation between the Flesch and the Flesch-Kincaid tests ($r=-.007$, $p > .1$ and $r=-.937$, $p > .1$).

Discussion

The purpose of this preliminary study was to attempt to determine the difference between CMC and non CMC messages. The results seem to indicate that there are some differences between the two types of messages. The computer mediated group did score higher on all of the tests. On the Flesch test the CMC group mean was 60.6 compared to 76.2 for the non CMC. The score indicates that the writing is more difficult to read and perhaps more sophisticated than the non CMC. The t-Test performed on the Flesch test did show that there was variance between the two groups.

The results of the Gunning index also showed that the mean for the CMC group was higher and that there was a slight variance between the groups.

The Gunning index may also show a higher level of sophistication for the CMC group. The Gunning index reading level for the CMC group was 11.2 compared to 9 for the non CMC. The t-Test analysis of the Gunning index showed only a slight variance between the two groups.

The Flesch-Kincaid tests supports the results of the Gunning index. The mean for the CMC group was 8.39 and the non CMC group was 6.4. The t-Test did show a higher level of variance than the Gunning index score. The results of the F K tests may also support the idea of the CMC group writing at a more sophisticated level than the non CMC group.

The basic assumption of the interpretation of the scores is that the higher the score the more sophisticated the writing. There are obviously other interpretation possible. The higher scores may indicated longer sentences or more words used in the paragraph. The higher scores may indicate that the writing is not as readable or as clear.

Extreme caution must be taken in interpreting the scores on the various tests and statistics. The small sample size makes generalizations very difficult. Since the study was a preliminary study the results may be encouraging. The small levels of variance between the CMC and non CMC groups may increase with a larger sample size if the trend is accurate. In a true CMC environment where the messages are composed off line and then placed into the message systems the sophistication and level of writing may be even greater.

The implications of the findings for teachers of technical writing may be that more on line writing skills need to be developed in writing courses. More time could be spent on actual CMC and writing. More advanced

assessment of the messages need to be established in order to clearly determine the levels of writing.

There are several implications for further study indicated here. The first is that a larger sample size is needed in order to make statistically sound conclusions. The second is that true computer mediated messages should be used from organizational settings. The third implication is that examples from the same population be used for the CMC and non CMC writing samples

If the trends continue for more use of the computer in on line writing and messaging, greater care will have to be taken in the teaching and implementation of computer mediated communication and message sending. The need for inclass extemporaneous writing may be transferred to inclass on line writing for students.

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Endnotes

1. For a more complete discussion of electronic message systems see for example: Gianturco and Behraves (1988), Microcomputers, Corporate Planning, and Decision Support Systems; Helliwell (1986), Inside Information; Kerr and Hiltz (1982), Computer-Mediated Communication Systems; Weidlein and Cross (1986), Networking Personal Computers in Organizations.

2. Some authors include the supercomputer as a separate category. A supercomputer is really nothing more than a mainframe computer connected to a number of minicomputers which has enhance processing speed.

3. Memory is usually represented in K (one thousand). One K equals 1024 bits, for example, 256K would equal 262,144 bits. The 256K would mean that the internal storage of the computer would hold approximately 262,000 characters.

4. Telecommunications is generally referred to as communicating over distances (Williams, 1987). Teleprocessing refers to processing performed by a computer system at a distance from the user (Burstein, 1986). Teleprocessing is made possible by telecommunications - teleprocessing what happens and telecommunications is part of what makes it possible. Most people seem to make little distinction between the terms and they are often used interchangeably.

Table 1

Summary of Correlation Analysis	
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CMC Group	Non CMC Group
$r_{\text{Flesch/Gunning}} = .144 (p > .1)$	$r_{\text{Flesch/Gunning}} = -.902 (p > .1)$
$r_{\text{Gunning/FK}} = .938 (p > .1)$	$r_{\text{Gunning/FK}} = .823 (p > .1)$
$r_{\text{Flesch/FK}} = -.007 (p > .1)$	$r_{\text{Flesch/FK}} = -.937 (p > .1)$

Table 2

Summary of t Test Analysis

Group	Test	Mean	S.D.	df	t	p
CMC	Flesch	60.6	10.3	8		
Non CMC	Flesch	76.2	4.4	8	2.73	<.05
CMC	Gunning	11.2	2.32	8		
Non CMC	Gunning	9	.632	8	1.83	<.1
CMC	F-K	8.39	2.32	8		
Non CMC	F-K	6.4	.64	8	2.09	<.05